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(71) Applicant : **VALMET PAPER MACHINERY INC.**
Panuntie 6
SF-00620 Helsinki (FI)

(72) Inventor : **Enkvist, Jens Petter**
Ruukinkatu 24
SF-20540 Turku (FI)

(74) Representative : **Rostovanyi, Peter et al**
AWAPATENT AB,
Box 5117
S-200 71 Malmö (SE)

(54) Method and device in a paper machine or in a finishing device of same for collecting and removing of dust that is separated from the web.

(57) The invention concerns a method in a paper machine or in a finishing device of same, in particular in a slitter-winder, for collecting and removing of dust (D) and equivalent that are separated from the web (W), in which method a blowing (P_1) is directed at the web (W), which separates dust (D) from the web (W), and in which method a suction effect (I_1,I_2) is applied to the web (W) so as to remove the separated dust (D) out of connection with the web (W). In the method, a high-pressure blowing (P_1) is directed at the web (W) so as to separate the dust (D) from the web (W), and in the method, in the running direction (S) of the web (W), before and after said high-pressure blowing (P_1), the dust and equivalent separated from the web (W) are sucked off. Further, the invention concerns a device in a paper machine or in a finishing device of same, in particular in a slitter-winder, for collecting and removing of dust (D) and equivalent that are separated from the web (W). The device (10) comprises a pressurized chamber space (11), in which there is a nozzle opening (12) for application of a blowing (P_1) to the web (W) and a suction opening/openings (13,23) for removing the dust (D) present in connection with the web (W). The air chamber (11) in the device (10) is pressurized, a high-pressure blowing (P_1) being fitted to be blown through the nozzle opening (12) of said air chamber (11) towards the web (W), and that the suction openings (13,23) of the device (10) are placed before and after said nozzle opening (12) in the running direction (S) of the web (W).

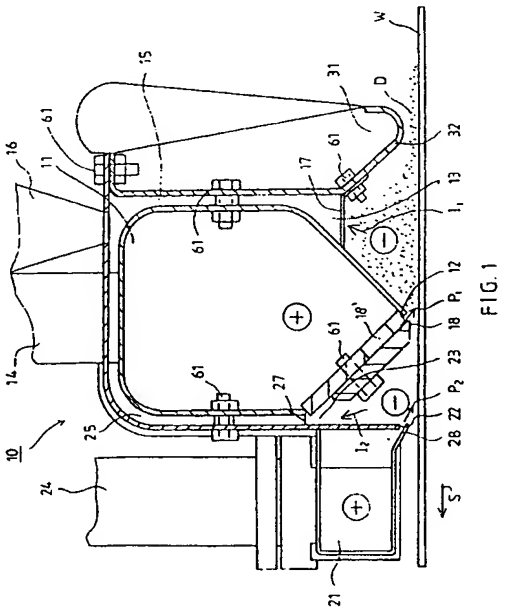

FIG. 1

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The invention concerns a method in a paper machine or in a finishing device of same, in particular in a slitter-winder, for collecting and removing of dust and equivalent that are separated from the web, in which method a blowing is directed at the web, which separates dust from the web, and in which method a suction effect is applied to the web so as to remove the separated dust out of connection with the web.

Further, the invention concerns a device in a paper machine or in a finishing device of same, in particular in a slitter-winder, for collecting and removing of dust and equivalent that are separated from the web, which device comprises a pressurized chamber space, in which there is a nozzle opening for application of a blowing to the web and a suction opening/openings for removing the dust present in connection with the web.

After the making of the paper, dust and impurities adhere to the face of the paper web, such as debris and fibres derived from the dryer section of the paper machine. A second, perhaps the most important, source of dust is the slitting process itself. This dust and these impurities cause problems in the further processing of the paper, in particular in printing, because keeping the printing rolls clean is of essential importance in view of the printing quality.

Also, dust spreads into the environment both in the paper mill and in the further processing, and the dust may involve health risks at work, because it may contain various filler particles.

With respect to the prior art, reference is made to the FI Patents **78,944** and **82,105**, in which devices and methods for dust removal are described for use in particular in the manufacture of tissue paper.

In the FI Patent **78,944**, a method and a device are described for collecting and removing the dust that is separated from the web in a paper machine, in which invention it has been considered the principal novelty of the method that, in the method, blowings are applied to the web, which blowings both support the moving paper web free from contact and separate dust from the web and, moreover, at least partly carry the dust to its site of collecting. In the device for carrying out the method, it has been considered novel that the device comprises one or several dust suction boxes, in which there are two nozzle boxes separated by an intermediate space, coanda nozzles or equivalent blowing in opposite directions being placed at the sides of said nozzle boxes, that said intermediate space communicates with a suction space subjected to a vacuum, and that at the rear side of said dust suction box, there is a rear suction space, which is opened against the by-passing web and which communicates with a suction space subjected to a vacuum.

In the FI Patent **82,105**, a method is described for removing the dust that is made free in connection with the detaching-crêping of a soft-tissue web by means of the crêping doctor from a yankee cylinder, in which connection part of the dust is carried along with the boundary layer consisting of air, which boundary layer is caught by the effect of the running of the web from the yankee cylinder towards the reel-up and follows along with the web. In the method, it has been considered novel that the dust removing device, which is provided with an interior space and with a unified plane that stabilizes the web, is placed directly against the path intended for the crêped web, so that, during its running, the web obtains a specified position tightly against the unified plane, and that, exclusively by sucking into the interior space, at least a substantial proportion of the boundary layer that contains dust is removed. In said patent, a device is also described for carrying out the method, and it has been considered novel in said device that the device comprises a path of a width equal to the width of the web, in which path there is, in the running direction of the web, a forward side edge and a rear side edge, a solid plane covering plate, which are arranged substantially to enclose the path while defining an interior space and while forming a slot between the covering plate and at least one of said side edges, members for producing a vacuum in the interior space so that air is sucked in through the slot, said device being supposed to be installed so that the covering plate is placed directly against the path of transfer of the crêped web, whereby the plane, unified covering plate produces an effect stabilizing the web, so that, during its running, the web obtains a precise position tightly against the covering plate and the slot is placed in the boundary layer that contains dust.

With respect to the prior art, reference is also made to the US Patent **4,715,078**, in which a method and a device are described for cleaning the edges of a paper web at a slitter-winder and for removing the dust detached from the edges. In the device, two cleaning rolls are used, which are placed strategically in the path of running of the paper web. The first cleaning roll contacts the forward edge of the paper web when the paper web runs further from the slitter. At the same time as the paper web runs further, its upper face is also cleaned by the same roll. The second cleaning roll cleans the rear edge of the paper web as it runs further. By means of this roll, the lower face of the paper web is also cleaned. After this, by means of the vacuum system, the particles that are detached by the cleaning rolls are removed, and all of the four edges of the paper web are also cleaned. The pressure system removes the particles from the face of the paper web so that they can be carried off by means of the vacuum system.

In the US Patent **3,239,863**, a web cleaning device is described, in which a chamber space is employed, in which two air nozzles directed towards the web have been formed, the space between the nozzles being closed so that it forms an exhaust chamber

for the air discharged from the nozzles and for the dust detached from the web.

A problem in these prior-art devices is how to produce a sufficiently high air blow velocity to detach dust adhering to the web, and also the necessity of constructing the devices so that they are placed quite far from the web, in which case they are mainly suitable for general dust removal, but not for detaching dust and impurities from the web.

The object of the invention is to provide a method and a device for removal of dust, by means of which method and device it is also possible to detach dust and impurities adhering to the web and so also to clean the environment from dust and/or to prevent spreading of dust into the environment.

It is a further object of the invention to provide a dust removing device that can be operated close to the web without a risk of damage to the paper web.

It is a further object of the invention to provide a device that can be shifted away from the path of the web in the event of a web break and/or during tail threading.

In view of achieving the objectives stated above and those that will come out later, the method in accordance with the invention is mainly characterized in that, in the method, a high-pressure blowing is directed at the web so as to separate the dust from the web, and that in the method, in the running direction of the web, before and after said high-pressure blowing, the dust and equivalent separated from the web are sucked off.

Further, the device in accordance with the invention is mainly characterized in that the air chamber in the device is pressurized, a high-pressure blowing being fitted to be blown through the nozzle opening of said air chamber towards the web, and that the suction openings of the device are placed before and after said nozzle opening in the running direction of the web.

By means of the device in accordance with the invention, it is possible to remove the dust and impurities adhering to the face of the web, which dust and impurities cause problems in the further processing of the paper. Also, the dust load in the machine hall is reduced, whereby the working environment is also improved.

According to a preferred exemplifying embodiment of the invention, the device consists of two blow nozzles, of which one is a high-pressure dust-detaching nozzle and the other one a low-pressure air-curtain nozzle, by whose means the detached dust is prevented from being carried into the machine hall, as well as of two suction zones, into which the dust and impurities detached from the web are sucked. The device communicates with an air system, which carries the contaminated air into a wet separator or to some other, equivalent filter, from which the air is passed either out of the machine hall or back into the machine hall.

In the nozzles in accordance with the invention, the distance of the blowing from the web is very little, 2...5 mm, preferably just about 2...3 mm, and the pressure used in the air space of the first air nozzle is 20,000...30,000 Pa, preferably 20,000... 25,000 Pa, and the pressure in the air space of the latter nozzle is 300...1000 Pa, preferably 300...500 Pa, for example about 400 Pa.

In a preferred exemplifying embodiment, the slot in the blow nozzle is 0.5 mm, and the blow velocity employed in it is 200 metres per second. In the suction nozzles, a high duct velocity is used, about 25...50 m/s, preferably about 30...40 m/s, in order that the contaminations present in the air should not adhere to the duct walls.

The method and devices in accordance with the invention are usable in the paper machine and in its finishing equipment, in particular in connection with a slitter-winder. In a slitter-winder, the dust removing devices are placed after the slitting as close to the slitting itself as possible, at each side of the web.

In connection with the device, measurement and guide devices are fitted, by whose means the distance of the device from the web is kept at the desired level and by whose means, in the event of a web break or any other disturbance, the device can be shifted apart from the web. The device is attached to the frame constructions of the machine displaceably.

In the method in accordance with the invention, the dust is detached from the web, the dust is removed, and the web is kept far enough from, but at the same time sufficiently close to, the blow device.

In the following, the invention will be described in more detail with reference to the figures in the accompanying drawing, the invention being, however, by no means supposed to be strictly confined to the details of said illustrations.

Figure 1 is a schematic vertical sectional view in the machine direction of a device in accordance with the invention.

Figure 2 is a schematic vertical sectional view of a device in accordance with the invention as fitted at a slitter-winder in the running position.

Figure 3 shows the situation shown in Fig. 2 in the web threading position.

Figure 4 is a schematic illustration of a device in accordance with the invention in the direction of width of the web.

Figure 5 shows a schematic air diagram for the device in accordance with the invention.

Figure 6 is a schematic illustration of an exemplifying embodiment of the arrangement in accordance with the invention at a slitter-winder.

In the exemplifying embodiment of the invention that is illustrated schematically in Fig. 1, a dust removing device 10 is placed above the web W. The web W proceeds in the direction S. The device 10

comprises a pressurized chamber 11, into which blow air is introduced along the duct 14. Out of the nozzle opening 12 of the chamber 11, an intensive blow P_1 is blown towards the web so that any impurities and dust particles D adhering to the web are detached from the web W. Before the blow opening 12, there is a suction opening 13, which removes the detached dust and contamination particles D, by a suction effect, through the suction opening 13 into the suction duct 15 and through it further into the exhaust duct 16. The blow P_1 blown out of the nozzle opening 12 is a high-pressure blow, whereas the blow P_2 passed out of the chamber 21 into the blow opening 22 is a low-pressure blow and operates as an air curtain nozzle, by whose means the detached dust D is prevented from being carried into the machine hall and from being carried further along with the air layer moving along with the web W. Into the blow chamber 21, the air is passed along the duct 24. Between the first blow nozzle 12 and the second blow nozzle 22, there is a second suction opening 23, which further sucks any particles of impurities and dust D that may be present in the area between said nozzles into the suction duct 25 and from it further into the exhaust duct 16. The device also includes a chamber 31, out of which, through the nozzle opening 32, blow air is passed towards the web W when the device is used for tail threading of the web W (Fig. 3).

The blowing P_1 detaches the dust from the web W and, at the same time, keeps the web W far enough from the constructions of the device 10. The nozzle openings 12,22 are continuous slot nozzles, whose gap width is 0.2...1 mm, preferably for example 0.5 mm. The nozzle openings 12,22 extend in the transverse direction of the web W across the substantial width of the web W. The distance E of the device 10 from the web is 2...6 mm, preferably 2...3 mm, during running. The blow velocity of the blowing P_1 is, for example, 150...200 m/s, and the pressure employed in the chamber 11 is 20,000...30,000 Pa, preferably 20,000...25,000 Pa. The blow velocity of the blowing P_2 is, for example, 30...50 m/s, and the pressure employed in the chamber 21 is 500...1500 Pa, preferably about 500...750 Pa. The suction velocity in the suction openings 13,23 is 25...50 m/s, preferably about 30...40 m/s. The gap width of the suction opening 13,23 is about 5...20 mm, preferably 10...15 mm. It is a basic starting point of the dimensioning that the amount of air that is sucked through the suction openings 13,23 is about twice as large as the amount of air that is blown through the nozzle openings 12,22. In this way it is ensured that the dust detached from the web is not spread into the environment. The second blow nozzle 22 produces the blowing P_2, which, as was stated above, operates as an air curtain nozzle, which prevents any dust that may have been carried beyond the suction opening 23 from being carried further along with the web W and which also prevents spreading of the dust into the environment.

The suction openings 13 and 23 are preferably provided with a perforated plate/net 17,27, which prevents access of any chaffed paper formed, for example, in connection with a web W break into the device 10.

The device 10 is composed of sheet constructions, which have been shaped in the forms of the necessary chambers and ducts and which are assembled together by means of fastening members 61 which permit disassembly of the parts for the purpose of cleaning of the device 10. The nozzle plates 18 of the first nozzle opening 12 have been manufactured by machining, in which case the accuracy of the nozzle opening 12 can be made adequate. The nozzle plates 18,18' have also been interconnected by means of fastening members 61, whereby cleaning of the chamber 11 and so also cleaning of the nozzle opening 12 is easy if cleaning is necessary.

In Fig. 2, an exemplifying embodiment of the device in accordance with the invention is placed in connection with a web guide roll 49 after the slitter. The device 10 is in the running position, in which case it operates in the way described above in relation to Fig. 1. The device 10 is attached to the other frame constructions 100 of the machine in a way in itself known, and the running of the web W is also guided by an auxiliary roll 101 fitted in connection with the device 10.

In Fig. 3, the device 10 has been shifted away from the vicinity of the web W for the time of the tail T threading of the web W. Then, a nip N is formed between the auxiliary roll 101 and the web guide roll 49, through which nip the tail end T of the web W is passed. Out of the blow chamber 31 of the device 10, blowings P_3 are blown which aid in the tail threading of the web W.

Fig. 4 is a schematic sectional view of a dust removing device 10 fitted on a spread (deflected) web W. The device 10 has been divided into a necessary number of blocks 10', whereby the blowings can be fitted in accordance with the curve form of the web W. The number of the blocks 10' is 3...5, preferably 3, depending on the width of the web W. The distance E' of the blocks 10' from the web W is measured by means of measurement devices 40', for example, at the junction points between the blocks 10', and the data on the distances are passed to the control device 50.

Fig. 5 shows a schematic air diagram. Dust is sucked out of the web W through the suction zones 13,23 into the exhaust duct 16, from which the dust-containing air is passed to the washer 53, to which water is passed through the valve 54. After the washer 53, the air is passed into the dust separator 55, after which the air is passed through the exhaust blower 56 to the open air or back into the machine hall.

The clean filtered air is passed through the blow-air blower 52 into the blow-air ducts 14,24, and from

them further into the blow chambers 11,21, from which, as is shown in Fig. 1, out of the chamber 11 the dust-detaching blow P_1 is blown towards the web W, and out of the chamber 21 the air-curtain blow P_2 is formed.

In connection with the device 10, a measurement device 40 is fitted, which measures the distance E of the device 10 from the web W, for example, by means of ultrasonic or laser measurement. From the measurement device 40, the information on the distance is passed to the control device 50, which regulates the distance E of the device 10 from the paper web W to the desired level, 2...6 mm, preferably 2...3 mm. The position of the device 10 in relation to the web W is regulated constantly, because, for example, on the spreader rolls placed after the slitter, the spreader roll may move up to 150 mm.

The control device 50 controls the movement of the device 10 on the frame constructions 100 of the machine. The arrangements of transfer of the device 10 can be carried out by means of guide and/or equivalent arrangements, which are known in themselves to a person skilled in the art. The control device 50 also controls the operation of the device so that, for example, in connection with a web break, the device is shifted apart from the path of the web W.

Fig. 6 shows devices in accordance with the invention as fitted in connection with a slitter 45. In the slitter 45, component webs of desired width are slit out of a web W of full width, which component webs are wound by means of the winder 48 into customer rolls. One device in accordance with the invention is fitted at the wire guide roll 49 placed after the slitter 45, at the opposite side of the web W, the next device is placed before the spreader rolls 46 at the same side of the web W, however, at the opposite side in relation to the former dust removing device. Finally, the web W is passed to the winder 48.

Above, the invention has been described with reference to some preferred exemplifying embodiments of the invention only, the invention being, however, not supposed to be strictly confined to the details of said embodiments. Many variations and modifications are possible within the scope of the inventive idea defined in the following patent claims.

Claims

1. A method in a paper machine or in a finishing device of same, in particular in a slitter-winder, for collecting and removing of dust (D) and equivalent that are separated from the web (W), in which method a blowing (P_1) is directed at the web (W), which separates dust (D) from the web (W), and in which method a suction effect (I_1,I_2) is applied to the web (W) so as to remove the separated dust (D) out of connection with the web (W), **characterized** in that, in the method, a high-pressure blowing (P_1) is directed at the web (W) so as to separate the dust (D) from the web (W), and that in the method, in the running direction (S) of the web (W), before and after said high-pressure blowing (P_1), the dust and equivalent separated from the web (W) are sucked off.

2. A method as claimed in claim 1, **characterized** in that, in the method, the amount of air that is sucked is about twice as large as the amount of air that is blown.

3. A method as claimed in claim 2, **characterized** in that, in the method, to the web (W), in the running direction (S) of the web, after said high-pressure blowing (P_1), a low-pressure blowing (P_2) is applied, by whose means carrying further and spreading of the separated dust (D) is prevented.

4. A method as claimed in claim 2 or 3, **characterized** in that, in the method, to the web (W), blowings (P_1,P_2) are applied from a distance (E) of 2...6 mm, preferably about 2...3 mm, from the web (W).

5. A method as claimed in any of the claims 1 to 4, **characterized** in that, in the method, the distance (E) of the blowings (P_1,P_2) from the web (W) is measured, and that the distance (E) is regulated constantly during the running of the web (W).

6. A method as claimed in any of the claims 1 to 5, **characterized** in that, for the time of tail threading of the web (W), the dust-detaching blowing (P_1) and the air-curtain blowing (P_2) are closed, and a third blowing (P_3) is blown so as to aid the tail threading.

7. A method as claimed in any of the claims 1 to 6, **characterized** in that the dust-detaching blowing (P_1) is blown at a velocity of about 150.. .200 m/s.

8. A method as claimed in any of the claims 1 to 7, **characterized** in that the air-curtain blowing (P_2) is blown at a velocity of about 30...50 m/s.

9. A device in a paper machine or in a finishing device of same, in particular in a slitter-winder, for collecting and removing of dust (D) and equivalent that are separated from the web (W), which device (10) comprises a pressurized chamber space (11), in which there is a nozzle opening (12) for application of a blowing (P_1) to the web (W) and a suction opening/openings (13,23) for removing the dust (D) present in connection with the web (W), **characterized** in that the air cham-

ber (11) in the device (10) is pressurized, a high-pressure blowing (P_1) being fitted to be blown through the nozzle opening (12) of said air chamber (11) towards the web (W), and that the suction openings (13,23) of the device (10) are placed before and after said nozzle opening (12) in the running direction (S) of the web (W).

10. A device as claimed in claim 9, **characterized** in that a second air chamber (21) in the device (10) is subjected to a low pressure, a blowing (P_2) that operates as an air curtain being directed at the web (W) through the nozzle opening (22) of said air chamber (21).

11. A device as claimed in claim 9 or 10, **characterized** in that the device comprises means (40,50) for measurement and regulation of the distance (E) of the device (10) from the web (W) so that the distance (E) of the device (10) from the web (W) remains constantly at the desired level.

12. A device as claimed in any of the claims 9 to 11, **characterized** in that the device further comprises a third air chamber (31), out of which, through the nozzle opening (32), a blow (P_3) is fitted to be blown during tail threading of the web (W).

13. A device as claimed in any of the preceding claims, **characterized** in that the device is composed of constructions that have been interconnected detachably by means of fastening members (61) so that the constructions can be disassembled apart from one another for cleaning of the device.

14. A device as claimed in any of the preceding claims, **characterized** in that the nozzle openings (12,22) for dust-detaching and air-curtain blowing (P_1,P_2) extend across the substantial width of the web (W), and that said nozzle openings (12,22) are slot nozzles.

15. A device as claimed in any of the preceding claims, **characterized** in that the suction openings (13,23) are provided with perforated plates (17,27) in order to prevent access of chaffed paper or equivalent into the device (10).

16. A device as claimed in any of the preceding claims, **characterized** in that the device (10) is composed of blocks (10') so that the shape of the face of the device (10) that is placed facing towards the web (W) substantially complies with the curve form of the web (W) in the direction of width of the web (W).

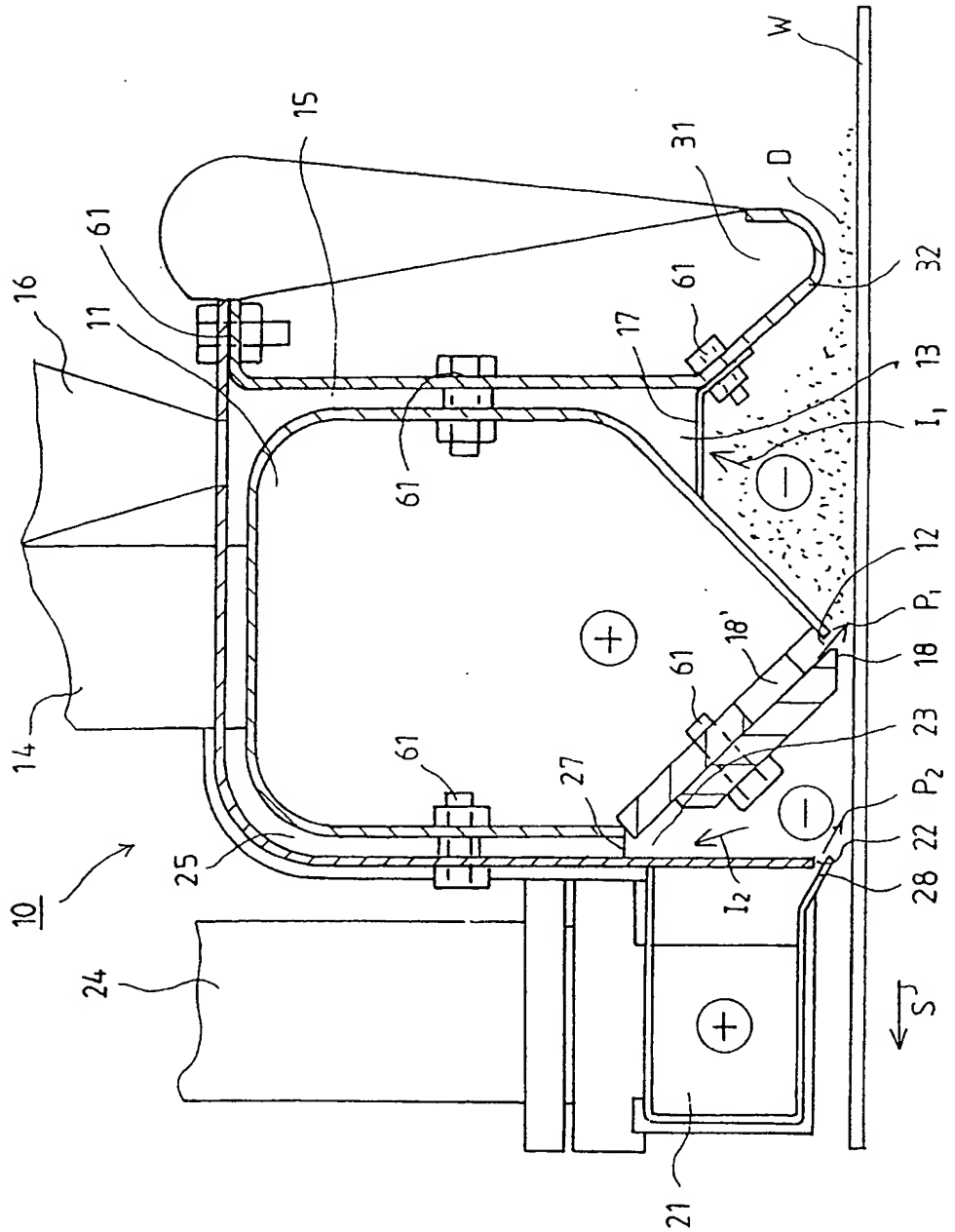
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FIG. 1

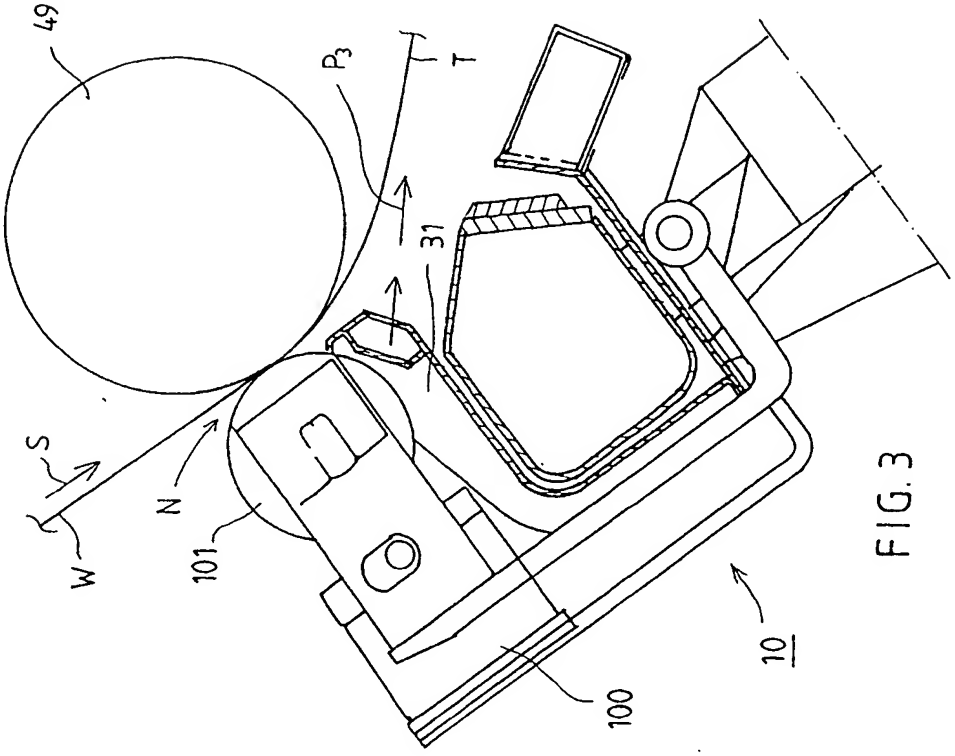

FIG. 3

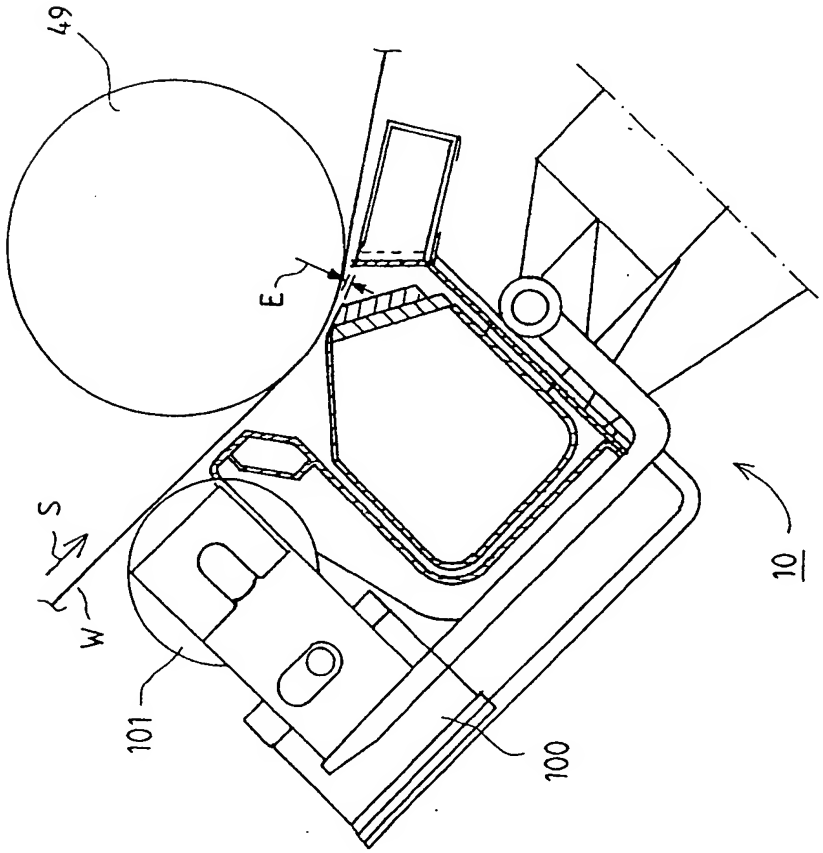

FIG. 2

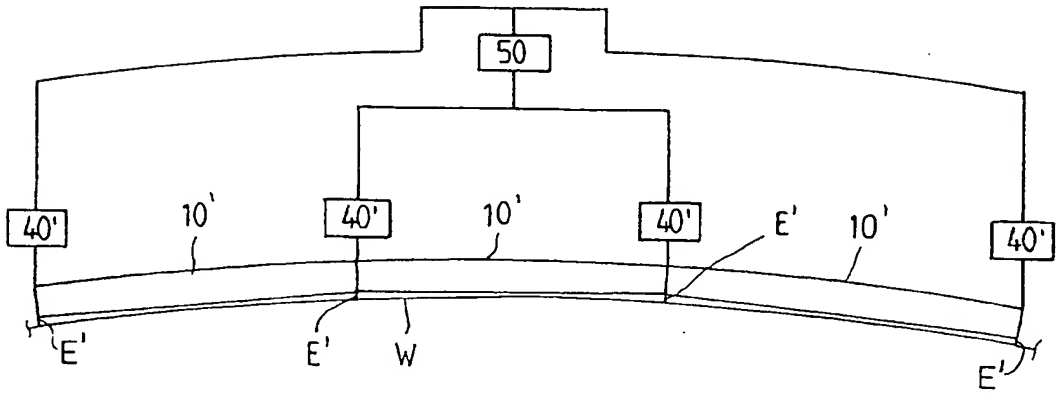
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FIG. 4

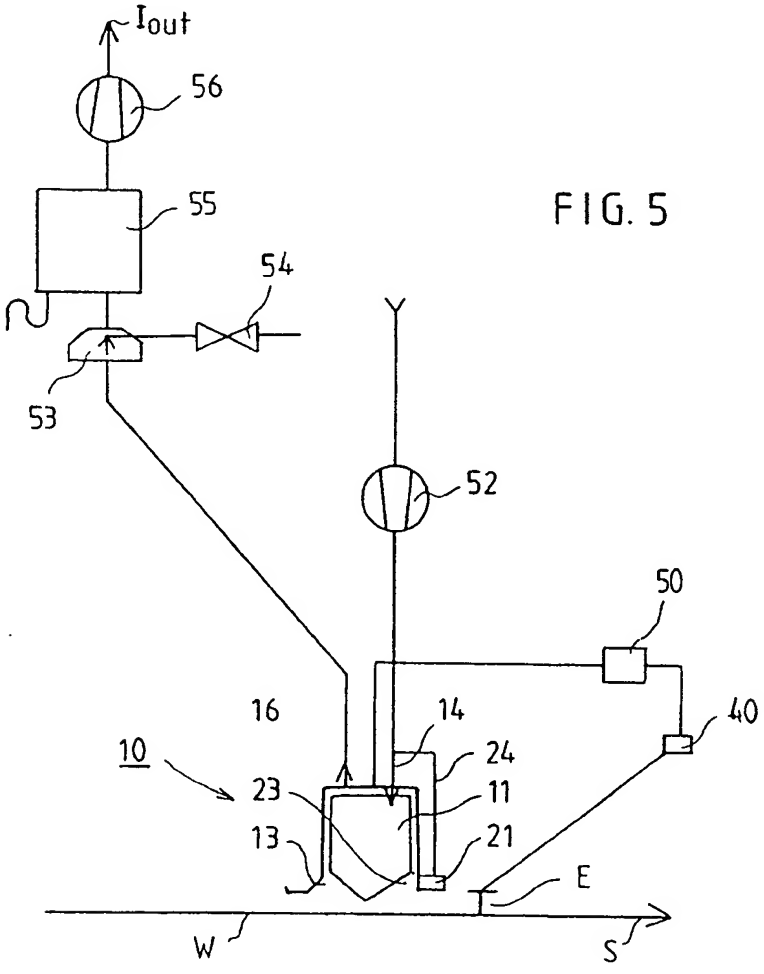
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FIG. 5

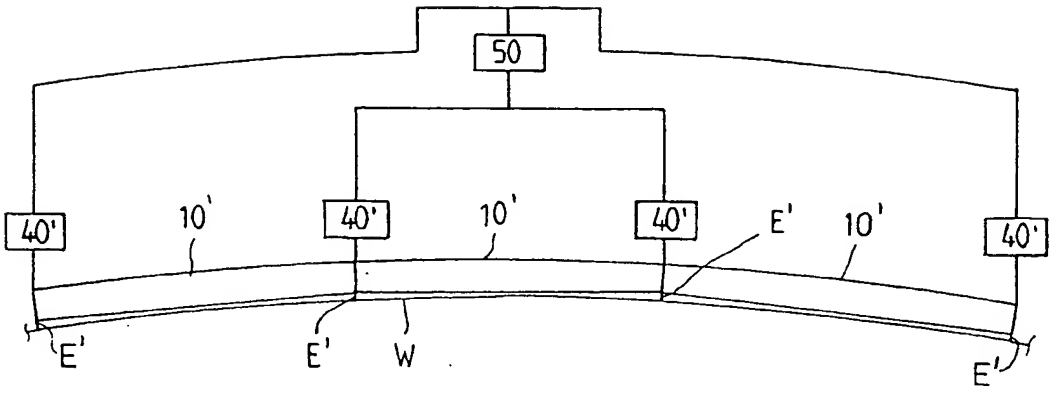
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FIG. 4

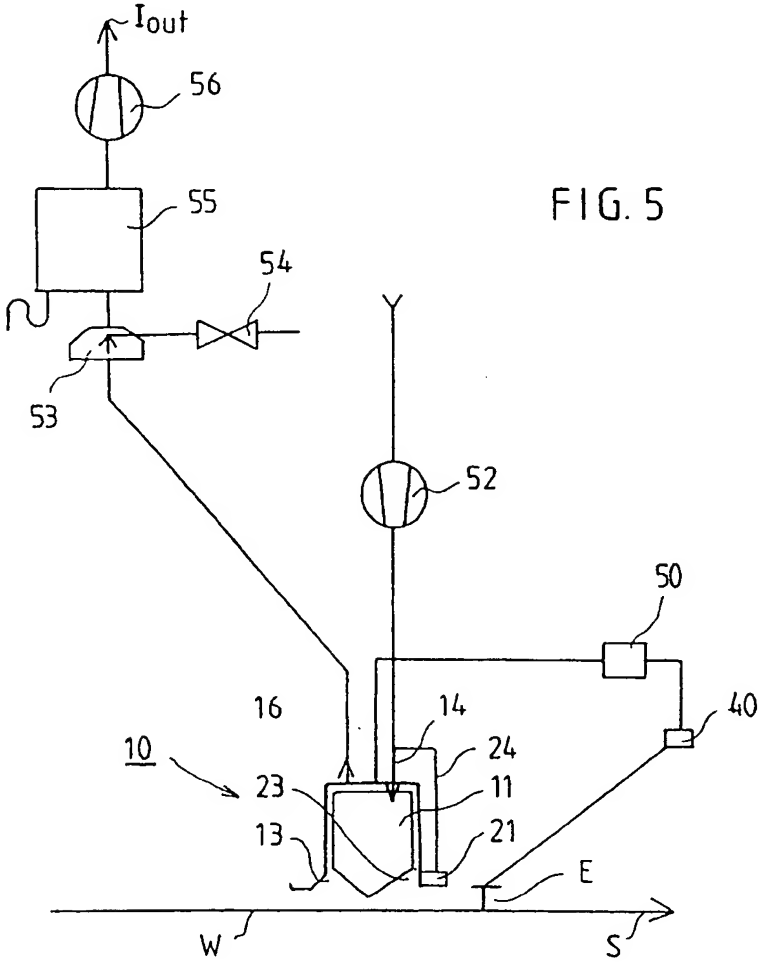
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FIG. 5